High resolution record of millet cultivation during the Bronze Age around Lake le Bourget (French Alps). Is there any climatic control?

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Our understanding of past interactions between the development of human societies, the evolution of climate and associated changes in ecosystems and landscape dynamics is conditioned by the acquisition of high resolution records within which specific tracers allow us estimating variability. The recent development of a molecular biomarker (miliacin) specific of *Panicum miliaceum* (common millet) associated with the determination of a biomarker allowing to track soil erosion in the sediments of Lake le Bourget (French Alps; [1], [2]) expands the possibilities afforded by organic geochemistry applied to sedimentary archives to unravel these interactions.

Within the frame of the Pygmalion project (ANR Blanc, France) we improved the previous miliacin record from Lake le Bourget sediments [1] to reach an infra-decadal resolution for the 2000-600 BC time period that covers the Bronze Age. Miliacin is detected for the first time in sediment samples dated back to ca. 1700 BC, in agreement with the supposed date of introduction of *P. miliaceum* in the region. Miliacin concentration is low (ca. 20 $ng.g^{-1}$) during the 1700-1400 BC interval and then rises to values up to 300 $ng.g^{-1}$ at 850 BC before the strong decrease to 20 $ng.g^{-1}$ at 750 BC imputable to the abandonment of palaffitic habitats due to a climatic deterioration at the Bronze Age/Iron Age transition. In addition to this general trend, miliacin concentration shows century-scale variations in the 1700-800 BC interval that share similarities with other records. Two periods of miliacin high concentrations at 950 and 850 BC coincide with high densities of dendrochronological dates acquired on wooden piles and with two periods of lake level lowering.

The comparison of miliacin evolution in Lake le Bourget with the high resolution alkenone-derived sea surface temperature (SST) record obtained in the North Atlantic off Iceland [3] shows striking coincidences. Previous studies showed that periods of elevated SSTs in this area coincide with favourable climatic conditions in Europe (Mediaeval Warm Period for example) [4]. Our data indicates that the beginning of millet cultivation coincides with a period of elevated SSTs that is followed by lower temperatures, when miliacin concentration is low. Then, century-scale periods of miliacin high concentrations follows century-scale oscillations of elevated SSTs from 1400 to 800 BC.

A relationship between population density around Lake le Bourget and climate variations cannot be disregarded at this stage. We are currently improving the miliacin record from another core drilled in Lake le Bourget in which miliacin shows the same global trends [2] to support these findings.

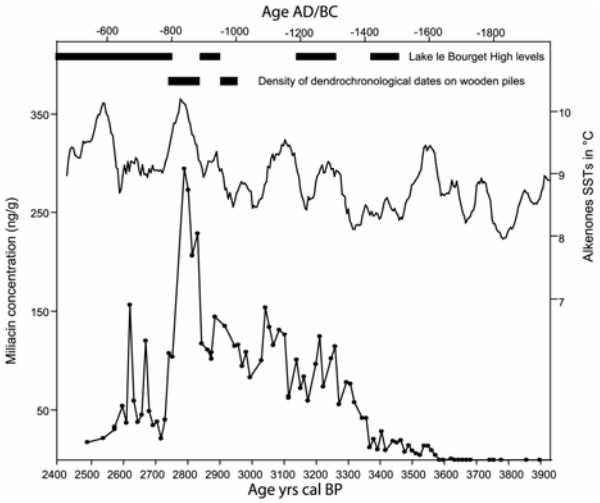

Fig. 1. Evolution of miliacin concentration, density of dendrochronological dates measured on wooden piles and periods of high lake levels for Lake le Bourget and alkenones-based SSTs reconstruction off Iceland for the 2000-600 BC time period.

References

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